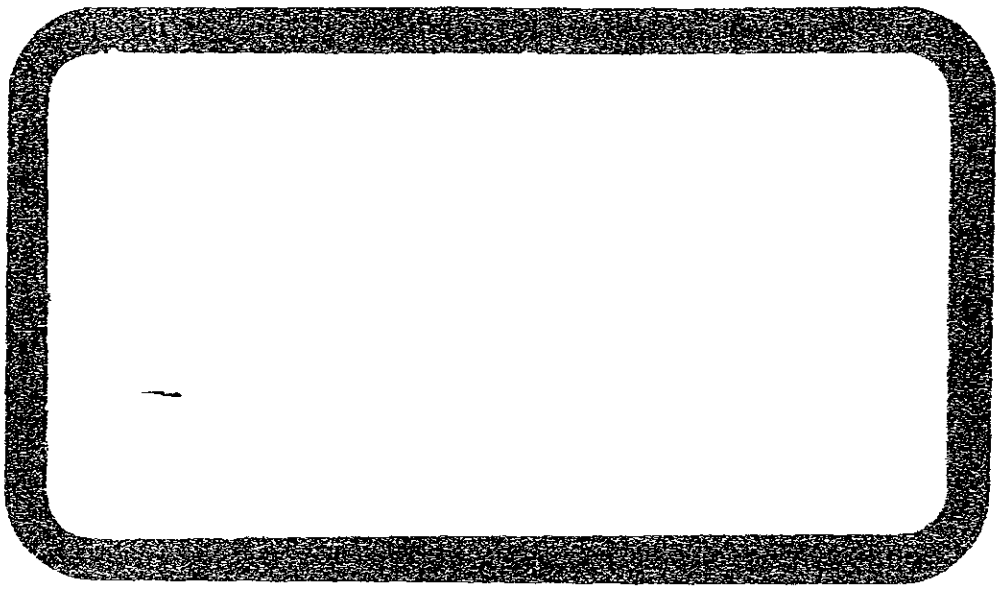

EMPLOYEE - OWNED
Burns & McDonnell
ENGINEERS - ARCHITECTS - CONSULTANTS
Kansas City, Missouri

HEALTH PROFILE

FOR

FOREST PRODUCTS DIVISION FACILITY
KERR-MCGEE CHEMICAL CORPORATION
KANSAS CITY, MISSOURI

MAY 11, 1992

91-382-4-001

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1.0 INTRODUCTION

1.1 PURPOSE

A health profile is required by RSMo 260.395.7(5) as part of a hazardous waste permit application to the Missouri Department of Natural Resources. The purposes of the profile are to outline and identify the substances routinely handled (treated, disposed, etc.) at the facility and the human health effects associated with exposure to these substances. The health profile documents population rates for these health effects so that changes in rates may be monitored over time.

1.2 FACILITY

This health profile concerns the former Kerr-McGee Chemical Corporation Forest Products Division facility located in an industrial area at 2300 Oakland Street in Kansas City, Jackson County, Missouri (see Figure 1). The facility was operational from the early 1920s up until deactivation in the mid-1980s. Following deactivation the facility area was extensively remediated. The permit application is for post-closure of the one regulated unit on the site, a wastewater impoundment. The principal product was treated wooden ties which were subsequently sold to railroad companies. The facility used creosote as the wood preservative in a pressure treatment system.

1.3 GEOGRAPHIC AREA

The regulation specifies that a geographic area around the facility site be identified and evaluated with regard to serious illness potentially associated with any hazardous substance at the facility. This site-specific region is to

consist of an area within a 3 to 5-mile radius around the site. A smaller or larger geographic area may be selected where appropriate and when acceptable to the Missouri Department of Health (DOH). The population within the site-specific area is presumed to have some potential for exposure to hazardous substances at or from the site. Comparison populations are drawn from the county where the site is located and the state. The county population is presumed to have lower exposure potential than the site-specific area population and the state population is presumed to have essentially no exposure.

* * * * *

2.0 METHODS

2.1 SELECTION OF STUDY AREA

The selection of the site-specific geographic region to comprise the study area attempted to resolve sometimes conflicting requirements. The first requirement is that the study area meet the regulatory guidelines, which specify a 3 to 5-mile radius around the site or comparable area acceptable to DOH. Secondly, it should include a population sufficient in size to allow meaningful statistical analysis. Thirdly, and most importantly, it should be limited, to the extent possible, to only that population reasonably expected to have some potential for exposure to hazardous substances at or from the site.

The first requirement was met in consultation with DOH officials who specified an area somewhat larger than a 5 mile radius and incorporating the postal zip codes depicted in Figure 2. The second requirement of sufficient population size was easily met since the selected zip codes are within a metropolitan area. The third requirement is the most difficult to address and to achieve since exposure can occur at various levels and through multiple pathways.

Exposure pathways describe the route taken by a substance from its source to the point at which human exposure may occur. For creosote, the most common pathway is direct skin contact and primarily occurs to workers directly engaged in the wood treatment process. Handling of treated wood products or contact with contaminated soil may also result in skin contact exposure. While workers may have some inhalation exposure, most of the constituents of

creosote do not readily volatilize. Therefore, the air pathway is not as significant as skin contact. There is some possibility of off-site exposure via inhalation of contaminated dust particles. However, the creosote released to the soil in treated timber storage areas would tend to help prevent significant dust generation.

Water soluble creosote constituents can reach surface water bodies or groundwater from rain runoff, leaching from soil, or release of wastewater. However, in an area with a public water supply, it is unlikely that exposure would occur due to ingestion of contaminated water.

In consideration of these requirements and factors, the selected study area approximated a 5 mile radius around the site, included sufficient population, and favored a downwind direction from the site. A wind rose diagram for the Kansas City International Airport is depicted in Figure 3.

It should be noted that there has been no documented exposure to creosote among the residents of the study area. A health profile is based on the presumption that exposure might have occurred in the past or could occur in the future. If so, it would be probable that the population in the defined study area would include those persons who were or might be exposed.

2.2 HAZARDOUS SUBSTANCES

Of the three general types of creosote, coal-tar creosote was the most widely used in the United States and the type used at the site. Creosote is a complex mixture of many different organic constituents. About 300 of these

constituents have been identified in coal-tar creosote; there may be up to 10,000 more organic compounds present in the mixture. The major constituents in creosote that can cause adverse health effects are polycyclic aromatic hydrocarbons (PAHs), phenol, and cresols.

2.3 HEALTH EFFECTS

Several publications[1,2,3,4] were reviewed to determine the possible health effects associated with exposure to creosote. Further, the Missouri Division of Worker's Compensation was consulted for statistics on occupational illnesses associated with similar industries. From these sources, a list of serious diseases which might possibly be related to creosote exposure was developed. This list and the corresponding International Classification of Diseases (ICD) codes[5] are presented in Appendix A.

Health effects depend, among other factors, on the level and duration of exposure. Occupational exposures are typically greater than the environmental exposures which might be experienced by the general population. The principal health effects reported as being associated with occupational exposure to creosote are dermatitis and skin cancer[4]. Additionally, some reports have linked multiple myeloma and cancers of the nasal cavity, larynx, lung, and scrotum to creosote exposure[1]. Relatively large exposures might result in gastrointestinal or liver effects, although instances would likely be few. The low doses typical of environmental exposure tend to preclude any systemic effects. Therefore, the potential health effect of most interest in the community would be cancer. It may also have been possible for trespassers on

the site, when it was active, to have had some skin contact exposure and consequent risk of skin disease.

Since the facility has not been active since 1983, health effects associated with high level, acute exposures to creosote and/or its constituents were not listed and not considered. The DOH health profile guidelines require the use of the most recent available data on community health status. As discussed below, the most recent data covers time periods after the facility was deactivated. Additionally, such exposures occur infrequently, are usually due to a spill or other accident, and would not broadly affect the community.

2.4 DATA SOURCES

Data requests were submitted to the DOH Bureau of Health Data Analysis and to the DOH Bureau of Cancer Epidemiology and Control. The requests included population data, mortality data, hospital discharge (morbidity) data, cancer incidence data, natality data, birth defect data, fetal death data, and other selected perinatal health indicators for the most current available 5 year or 7 year periods, depending on the data base. For mortality, natality, and fetal deaths this period was 1986 to 1990; for hospital discharges it was 1983 to 1987; and for birth defects it was 1980 to 1986. The cancer incidence data covers the years 1985 to 1989. Additionally, census reports[6,7,8] were reviewed for socioeconomic data.

2.5 STATISTICAL METHODS

The DOH Bureau of Health Data Analysis provided the calculated expected rates for mortality, morbidity, and perinatal indicator data. The expected rates of

mortality and morbidity were calculated by multiplying rates for each of five age groups (<14, 15-44, 45-64, 65-74 and 75+) in the comparison populations by the age group populations in the study area, then summarizing over all age groups. The expected rates for selected birth characteristics, birth defects, and fetal deaths were calculated by multiplying rates for state and county groups by the population in the study area. Tests of the statistical significance (probability less than 0.05) of the difference between the observed and the expected numbers of effects were calculated by the chi-square statistic if more than four cases were expected, and the Poisson statistic if four or less were expected.

The observed cancer cases were calculated for the study area by summing the observed cancers within the selected zip codes as reported by the DOH Cancer Registry. The expected cancer cases were calculated by multiplying rates for the state and county comparison groups by the population in the study area. The significance of the differences between the study area observed and expected effects was calculated by the chi-square statistic.

* * * * *

3.0 RESULTS

3.1 OVERVIEW:

This section summarizes in narrative form the information presented in data provided by DOH. Observed numbers of diseases or conditions that differ significantly from expected in the study area are discussed. Table 1 shows the age distribution data from the 1980 census for the specific zip codes in the site-specific study area, for Jackson County, and for the State of Missouri. The three comparison populations parallel each other very closely for all age groups.

3.2 CANCER INCIDENCE

Cancer incidence data from the Cancer Registry is presented in Appendix B and summarized in Table 2. Some significant differences between the numbers of observed and expected cases based upon county and state rates were found. The numbers of observed cases for cancer of the larynx and for cancer of the trachea, bronchus, and lung were statistically elevated compared to both county and state. Melanoma and the category of other skin cancers were statistically lower compared to the expected numbers based on the state rate.

3.3 MORTALITY

Mortality data for the period 1986 to 1989 are summarized in Table 3 from the information provided by DOH, which is presented in Appendix C. These data include the total number of deaths reported, deaths due to specific neoplasms, and deaths due to other selected causes. The numbers of observed cases were not statistically elevated in any category or overall. In fact, mortality categorized as all deaths (state and county), all neoplasms (county),

malignant neoplasms (county), and breast cancers (county) was lower than expected.

3.4 MORBIDITY

Table 4 presents the morbidity data from 1983 to 1987. This is a summary of the information provided from DOH and presented in Appendix D. The results show observed morbidity (as reflected by hospital discharges) both higher and lower than the state and county expected numbers for many selected diagnoses. The category of malignant neoplasms was higher than expected compared to the county, but not the state. However, the category of all neoplasms was not significantly different by either comparison. Neoplasms of the digestive, genital, and respiratory organs were statistically higher than expected. Diseases of the skin were also higher than expected as were some selected disorders of the digestive system.

3.5 NATALITY (Selected Characteristics and Fetal Deaths)

Natality data for selected characteristics and fetal deaths for the period of 1986 to 1990 are summarized in Table 5 from the data presented in Appendix E. Observed numbers for weight less the 2500 grams, gestation less than 37 weeks, and 5-minute Apgar score less than 8 (a measure of newborn health and responsiveness) were found significantly elevated when compared to expected based on both the state and county rates. The observed number for 1-minute Apgar score less than 8 was significantly higher than expected based on the state rate, but was not significantly different from expected based on the county rate. Differences in observed and expected numbers for total fetal deaths were not significant, with the observed total fetal deaths somewhat lower in the study area than expected.

3.6 NATALITY (Birth Defects)

Table 6 summarizes the 1980 to 1986 data contained in Appendix F from the multi-source birth defect registry. Births with anomalies were significantly higher than expected by the state rate, but not county. Anomalies categorized as respiratory system, genital organs, poly/syndactyly, club foot, musculoskeletal, and of skin, hair, and nails were significantly higher than expected compared to the state rate numbers. Other unspecified anomalies were also significantly higher. However, the only category that achieved statistical significance when compared to the county was club foot.

* * * * *

4.0 DISCUSSION

4.1 OVERVIEW

Significant differences between observed and expected case numbers were found in many of the health effect categories reviewed. The numbers were higher than expected for some categories, lower than expected for others. However, the results from one data base were not always corroborated by the results for the corresponding effect from another data base. The following discussion reviews the results and compares information from the various data bases on the health impacts of most significance.

4.2 RESPIRATORY CANCER

Respiratory cancer incidences, as indicated by the Cancer Registry data, were significantly higher in the study area. Morbidity from respiratory neoplasms also was elevated in the study area. Mortality data, however, did not show a significant difference between observed and expected numbers. Mortality data collected from death certificates is more complete and more accurate than cancer incidence and morbidity data. In any case, respiratory health conditions are difficult to assess as a community health indicator because of confounding by other environmental or behavioral factors, principally smoking. Smoking occurrence has been reported to be associated with socioeconomic status[9], which, as discussed later in this report, may be a factor in the study area.

4.3 SKIN CANCER AND SKIN DISEASE

Reported skin cancers, in the categories of melanoma and other types unspecified, were found to be significantly lower than the calculated expected numbers based on the state rate. Morbidity data also showed a significantly

lower incidence of melanoma when compared to the state and also to the county. Morbidity data for the overall category of diseases of the skin showed elevated observed cases. However, contact dermatitis, a category that includes occupational dermatitis, was not elevated. Mortality data for skin cancer showed no significant differences. Skin cancer and dermatitis, since they are the health effects most closely linked with occupational creosote exposure, should be considered primary indicators for this study.

4.4 GENITAL ORGAN CANCER

Morbidity data for male genital organ cancers, one of the earliest reported cancers with a possible causal link to PAH exposure[4], did show an increase in the observed cases above expectation using the county rate. The cancer incidence and mortality data did not, however, show any concurrent increase. Since each data base dealt with very small or even fractional numbers of cases statistical analysis may not be meaningful. Fractional numbers of cases cannot exist, obviously, and small numbers of cases can occur randomly.

4.5 DISEASES OF THE DIGESTIVE SYSTEM

There were no significant differences found when comparing observed and expected mortality numbers attributed to disorders of the function of the stomach. Morbidity in the unspecified subcategory was elevated compared to the county rate expected figure. Deaths due to chronic liver disease and cirrhosis, with and without reported association to alcohol, were not found to be significantly different from expected. Morbidity data for these effects, however, did show a greater number of cases than expected using the state rate. Liver disease has not been specifically associated with exposure to creosote. Other environmental or life style factors may be involved.

4.6 NATALITY DATA

Perinatal indicators did show some statistically significant increases over expected numbers. The categories of low birth weight, short gestation, and APGAR scores of less than 8 were all elevated. These indicators are believed to be closely associated with socioeconomic variables such as nutrition, smoking habits, and availability of prenatal care[9,10]. Although several birth defect categories were elevated using the state rates, the only birth defect significantly elevated in the study area based on county rates was club foot. Some anomalies may be genetically related. Additionally, there may be better reporting of birth defects in a metropolitan area than in the state as a whole, causing the state rates to be artificially low. This might explain, at least in part, the significant differences noted using the state rates and the relative lack of differences using the county rates.

4.7 SOCIOECONOMIC STATUS

Socioeconomic status indicators were examined for the three population groups, since many diseases are negatively correlated with socioeconomic class[9]. Certain behaviors, such as smoking, drinking, and diet, as well as the availability of medical care (including prenatal care) have been shown to be related to socioeconomic class and to impact health. Table 7 summarizes several socioeconomic indicators: high school education, employment, income, and poverty level. The study area fared the worst by all indicators with the lowest values for education (based on high school graduation), employment, and income and the highest percentage of families living below the poverty level. Many of the differences noted in the reported health data may be at least partially attributable to socioeconomics and the multiple adverse effects associated with poverty, unemployment, and limited education.

4.8 CONCLUSION

The most pertinent indicators–mortality due to skin cancer and morbidity due to contact dermatitis–did not reveal any significant excess of cases in the study area. Further, deaths due to respiratory and genital organ cancer, which could also be plausibly related to creosote exposure, were not statistically elevated.

The significant differences noted in this study for some health effects may have many causes. Some may be due simply to chance; others may be attributable to differential or inaccurate reporting. There may be multiple exposures to low-level air pollutants in an industrial area and, for individuals, past exposure history from other geographical locations or occupations is important. Such exposures are critical confounding factors in any study of community health status. Community health surveys, including this one, frequently do not control for these variables[11]. Therefore, the results should be viewed with extreme caution.

No direct, causative association can be attributed to a particular environmental agent from a specific source for a specific time period with the data available in this study. The comparisons attempted here suggest only that some unknown associations or causes may exist and that further research would be required before definite causative agents or factors could be determined.

Finally, it should again be noted that exposure to creosote has not been documented in the study area population. In fact, it is probable that few of the 128,365 people living in the study area had any contact with the site or with creosote from the site. Therefore, the study area population may not be representative of the population potentially at risk[12].

* * * * *

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FIGURES

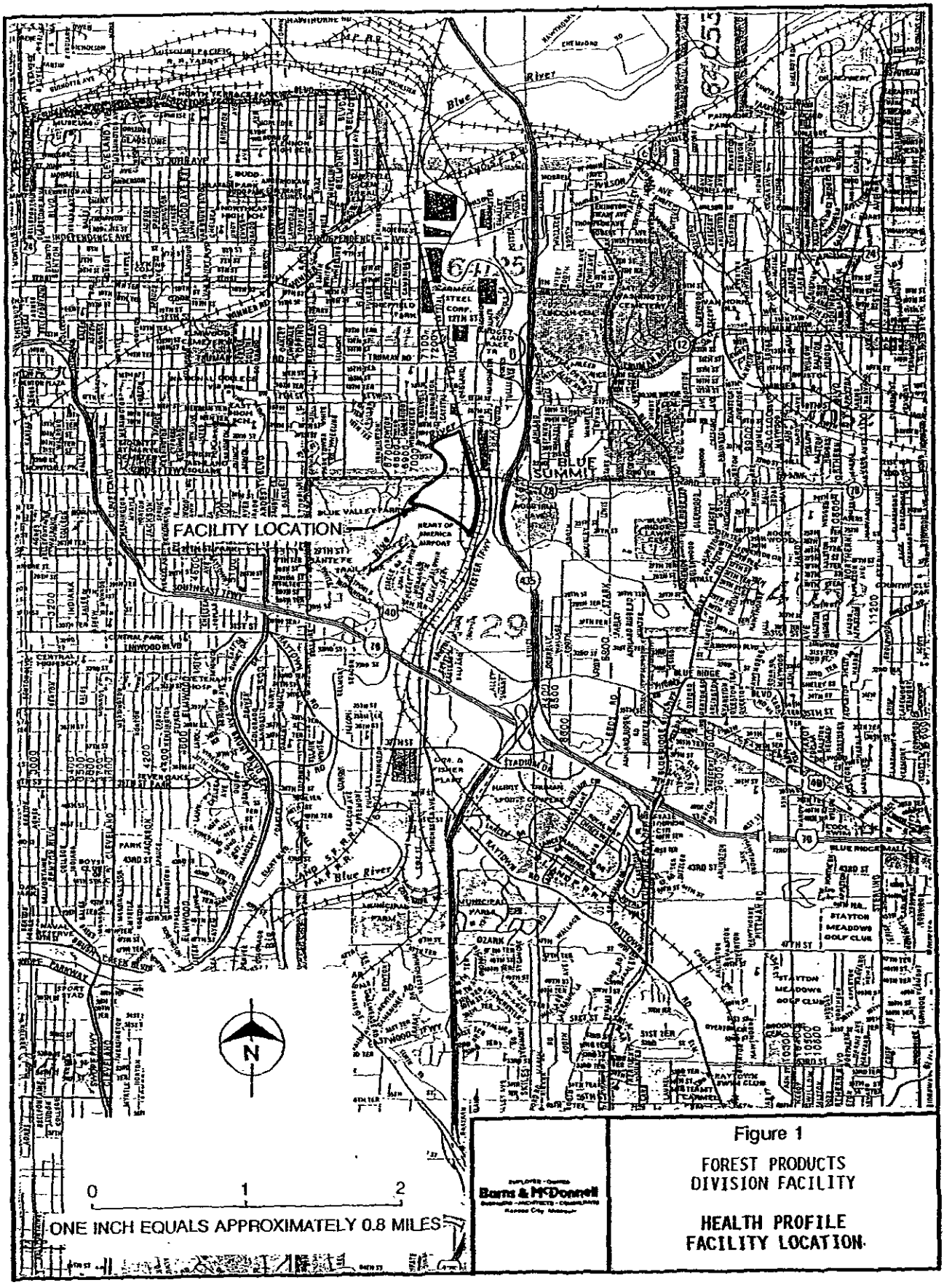
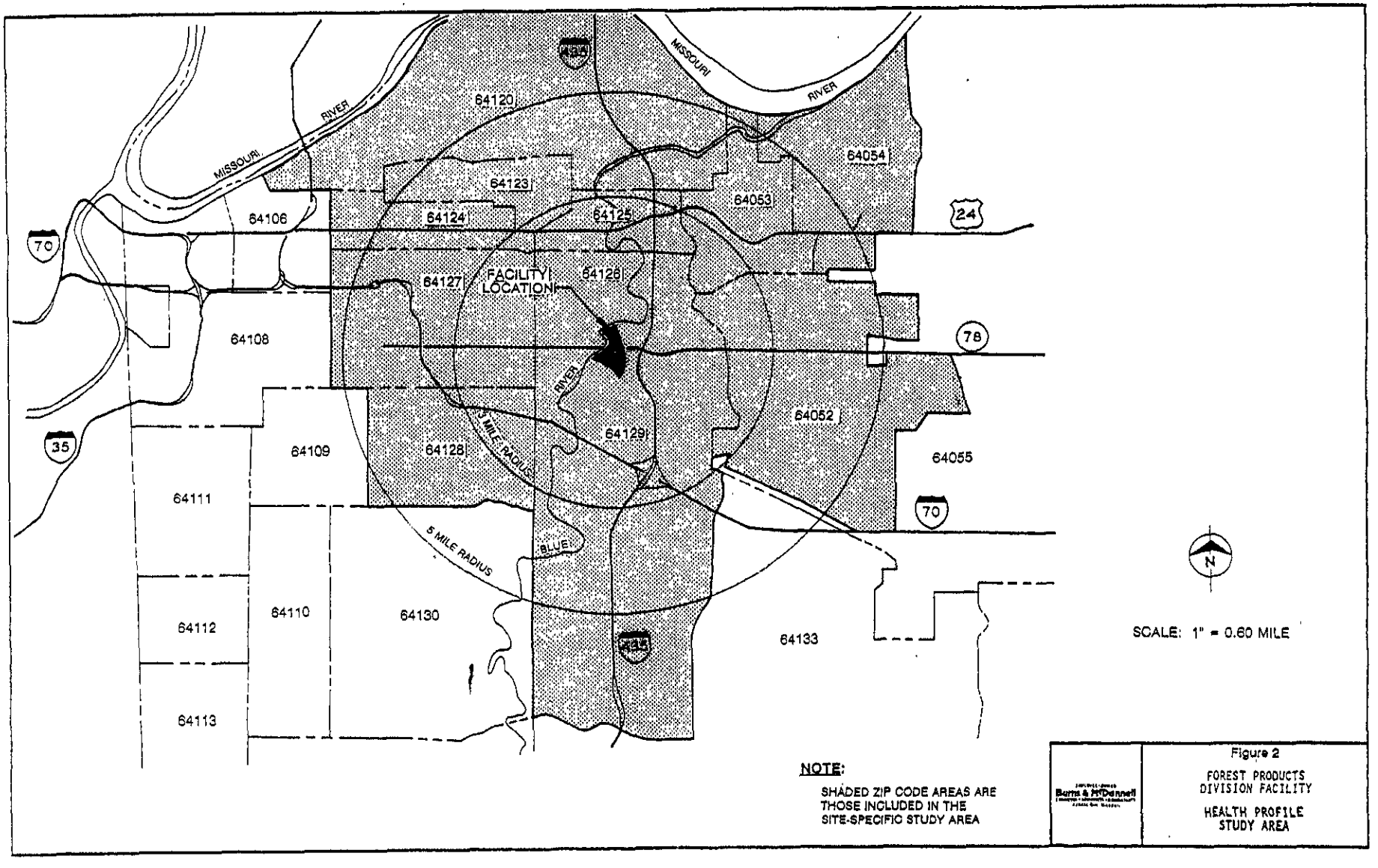
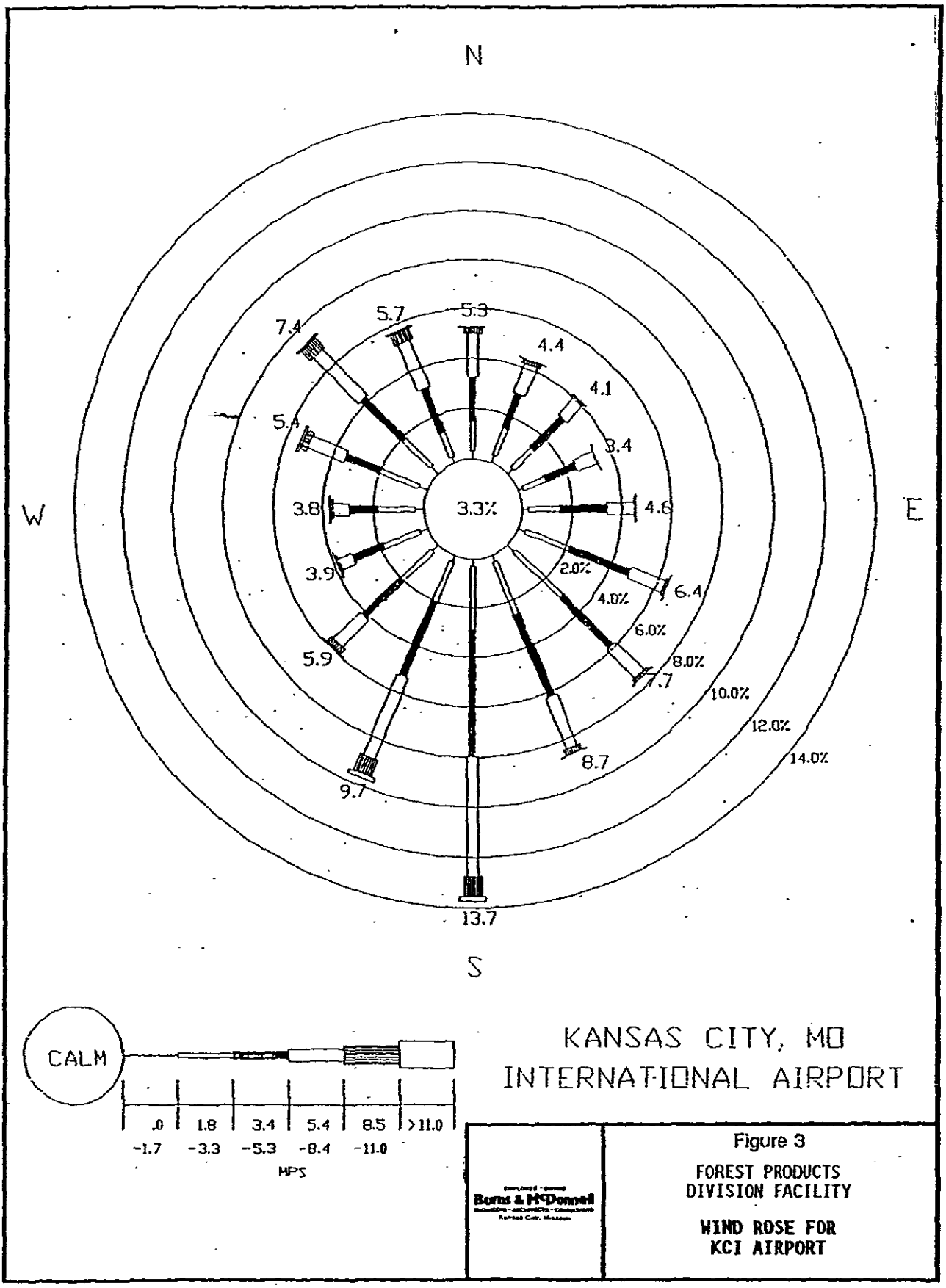


Figure 1

FOREST PRODUCTS
DIVISION FACILITY

HEALTH PROFILE
FACILITY LOCATION


MISSOURI RIVER
MISSOURI RIVER
64120
64123
64124
64125
64054
64053
64106
64127
FACILITY LOCATION
64126
64108
64109
64128
64129
64052
64055
64111
64112
64110
64130
64133
64113
5 MILE RADIUS
5 MILE RADIUS
BLUE RIVER
70
35
24
78
70
N
SCALE: 1" = 0.60 MILE
NOTE:
SHADED ZIP CODE AREAS ARE THOSE INCLUDED IN THE SITE-SPECIFIC STUDY AREA
Burns & McDonnell
Figure 2
FOREST PRODUCTS DIVISION FACILITY
HEALTH PROFILE STUDY AREA



KANSAS CITY, MO
INTERNATIONAL AIRPORT

Figure 3

FOREST PRODUCTS
DIVISION FACILITY

**WIND ROSE FOR
KCI AIRPORT**

Burns & McDonnell

TABLES

TABLE 1
1980 CENSUS POPULATION FOR SPECIFIC ZIP CODES,* JACKSON COUNTY, AND MISSOURI

Age	Specific Zip Codes	Jackson County	Missouri
<15	26,999	138,086	1,091,738
15-44	53,631	289,847	2,200,081
45-64	28,811	125,720	976,741
65-74	11,807	43,379	381,060
75+	7,117	32,234	267,066
TOTAL	128,365	629,266	4,916,686

* Zip Codes In Study Area include: 64052, 64053, 64054, 64120 64123, 64124, 64125, 64126, 64127, 64128, 64129.

TABLE 2
CANCER REGISTRY DATA
OBSERVED VERSUS EXPECTED CASES
DIAGNOSED FOR SELECTED CANCERS
1985–1989

Diagnosis	Observed Number in Study Area	Expected Number Based on Rates for:		Significant Differences in Study Area Data Compared to:	
		State	County	State	County
Male Genital Organs	6	3.9	3.9		
Melanoma	21	37.2	29.5	Lower	
Multiple Myeloma	29	25.0	21.8		
Other Skin Cancers	45	62.9	53.9	Lower	
Respiratory					
Larynx	57	32.7	37.2	Higher	Higher
Nasal Cavities	4	4.7	3.9		
Trachea, Bronchus, Lung	578	459.5	463.4	Higher	Higher
Other Ill-defined Sites	8	5.1	5.1		
Other Cancer Sites	2126	2087.2	2074.4		

TABLE 3
MORTALITY DATA
OBSERVED VERSUS EXPECTED DEATHS
1985–1989

Cause of Death	Observed Number in Study Area	Expected Number Based on Rates for:		Significant Differences in Study Area Data Compared to:	
		State	County	State	County
All Deaths	6,251	7,001.7	7,067.4	Lower	Lower
All Neoplasms	1,549	1,623.1	1,665.9		Lower
Malignant Neoplasms	1,527	1,603.8	1,646.6		Lower
Benign Neoplasms	7	4.9	6.0		
Neoplasms					
Breast	117	135.8	149.5		Lower
Digestive	354	364.2	375.8		
Genital Organs	161	168.7	168.1		
Male Genital Organs	0	0.6	0.7		
Scrotum	0	0.0	0.0		
Leukemia	43	58.8	55.0	Lower	
Melanoma of the Skin	11	18.1	18.8		
Multiple Myeloma	24	25.3	21.9		
Other Skin Cancers	11	8.5	9.2		
Respiratory					
Larynx	15	12.0	12.9		
Nasal Cavities	3	1.4	1.6		
Trachea, Bronchus, Lung	479	476.3	493.7		
Urinary Organs	55	63.7	62.3		
Other Selected Causes					
Disorders of Function of Stomach	0	0.6	0.2		
Dyspepsia	0	0.1	0.0		
Unsp. Functional Disorders of Stomach	0	0.4	0.2		
Other Diseases of Digestive System	137	123.7	142.9		
Chronic Liver Disease/Cirrhosis	70	57.5	74.2		
Cirrhosis w/o Alcohol	36	30.2	34.9		

TABLE 4
MORBIDITY DATA
OBSERVED VERSUS EXPECTED DISCHARGES
1983–1987

Principal Diagnosis	Observed Number in Study Area	Expected Number Based on Rates for:		Significant Differences in Study Area Data Compared to:	
		State	County	State	County
All Discharges	101,882	-	-		
All Neoplasms	6,094	6,201.9	6,075.9		
Malignant Neoplasms	4,845	4,764.6	4,664.8		Higher
Benign Neoplasms	1005	1,142.1	1168.6	Lower	Lower
Neoplasms					
Breast	409	460.3	478.9	Lower	Lower
Digestive	862	762.6	774.2	Higher	Higher
Genital Organs	717	689.3	656.5		Higher
Male Genital Organs	7	4.0	3.0		Higher
Scrotum	2	0.4	0.9		
Leukemia	133	137.3	113.1		
Melanoma of the Skin	24	41.6	36.8	Lower	Lower
Multiple Myeloma	59	60.6	57.1		
Other Skin Cancers	63	70.5	61.4		
Respiratory	930	762.5	795.2	Higher	Higher
Larynx	77	49.3	53.4	Higher	Higher
Nasal Cavities	4	9.0	6.4		
Trachea, Bronchus, Lung	834	693.7	724.4	Higher	Higher
Urinary Organs	338	317.4	320.0		
Other Selected Causes					
Diseases of the Skin	1,625	1282.1	1,467.6	Higher	Higher
Contact Dermatitis	30	30.8	24.9		
Hypertrophic/Atrophic	1	12.5	4.5	Lower	
Unspecified Hypertrophic/Atrophic	3	5.9	11.7		Lower
Disorders of Function of Stomach	101	125.0	93.9	Lower	
Dyspepsia	75	76.9	70.8		
Unsp. Functional Disorders of Stomach	22	32.8	13.2		Higher
Other Diseases of Digestive System	2,898	2808.9	2,756.7		Higher
Chronic Liver Disease/Cirrhosis	249	175.0	225.2	Higher	
Cirrhosis w/o Alcohol	68	52.9	56.5	Higher	